REMARKS

Claims 1-48 are pending in this application, of which Claims 15-45 have been withdrawn. Claims 1, 4, 5 and 48 are amended by this Amendment. Claims 1-14 and 46-48 have been rejected. These rejections are respectfully traversed and reconsideration is requested.

Title Objection

The title has been objected to. A replacement title is supplied herein.

Drawings Objections

The drawings have been object to under 37 C.F.R. 1.83(a) as not showing every feature of the invention specified in the claims. In particular, the Examiner has stated that "primary winding with two or more coils, different winding distribution, discrete concentric loops, SQUID sensor; the subject matter of Claims 9-10, Hall sensor, and rectangular loops" must all be shown in the figures. These objections are respectfully traversed and reconsideration is requested. However, Figures 4 and 5 have been amended to further the prosecution of this application. The support for the amended figures is found in the Detailed Description section of the present application (page 21, line 15 to page 22, line 24, and also page 25, line 20 to page 26, line 25) and the original Figures 4 and 5.

The amended Fig. 4 illustrates rectangular loops (22), a SQUID sensor (34) and a Hall sensor (37). The amended Fig. 5 illustrates the primary winding with two or more coils (31, 33), different winding distributions (as indicated by capital letters on windings 31 and 33), and discrete concentric loops (30). The subject matter of Claims 9 and 10 is shown in original Figs. 22-24 (see elements 54 and 64). All claim elements are now shown in the figures. No new matter has been added.

Rejections Under 35 U.S.C. 112

Claims 1-14 and 46-48 have been rejected under 35 U.S.C. 112 first paragraph as not complying with the enabling requirement. This rejection is respectfully traversed and reconsideration is requested.

The Examiner has stated that "it is unclear and not clearly understood as to: in what respect the two coils have different winding distributions, how the relative current directions are being switched, what are the discrete concentric loops,...." The Applicants respectfully disagree.

Adjusting the winding distributions is described at various locations throughout the original application. Two or more coils having different winding distributions is described at least on page 25, line 20 through page 27, line 8. Switching of the relative current direction is described in the same section. The phrase "discrete concentric loops" is used to describe the symmetric geometry of sensor windings having multiple circular aligned circular loops having the same center (see Fig. 5 and associated description).

Cylindrical and circularly symmetric geometries are described at least on page 26, line 13 through page 27, line 10. Discrete segment sensors in Cartesian and circular geometry sensors are described at least on page 28, line 26 through page 29, line 3. The amended Figs. 4 and 5 and associated description illustrate how the current direction is switched and how the primary winding can have different current distributions and concentric loops.

An example winding current distribution designed to excite a singular Fourier mode for the magnetic field is illustrated in FIG. 8 and listed in Table 1. For each segment, the sign for each value indicates the current direction while the integer indicates the number of conducting segments or relative current magnitude. When the drive winding is made from a single continuous conductor, such as a wire, the relative current in each loop can be varied by changing the number of turns and winding direction of the conductor.

Furthermore, as a point of discussion, Table 1 (page 25) provides an example listing of the relative current magnitude and direction in each rectangular loop of FIG. 4. For each loop, the sign for each value indicates the instantaneous current direction while the integer indicates the number of turns. For example, using the non-zero values of Table 1, loop A would have five counter-clockwise winding turns and, through lead 24, be connected to loop B, which has nine counter-clockwise winding turns. Similar connections would be made to loop C (12 turns), then loop D (13 turns), then loop E (12 turns), then loop F (nine turns) and then loop G (five turns), all of which would be wound in a counter-clockwise direction. Similar connections would also be made to the remaining clock-wise wound loops: loop H (five turns), loop I (nine turns), loop J (seven turns), and loop K (four turns).

In a similar fashion, Table 3 (page 27) lists an example set of relative current magnitude and direction for the loops in the windings of FIG. 5. Note that pattern A corresponds to the turn distribution of the upper winding 31 and pattern B corresponds to the turn distribution of the lower winding 33. The net number of turns or current in each loop of the drive winding is then the sum or difference of the turns in each corresponding loop of the individual windings 31 and 33, where the switch 43 controls the direction or polarity of the current into winding 33 relative to winding 31. For example, when the switch is in the lower position, as indicated in FIG. 5, the net number of turns (or current if driven at 1 A) in each loop is the sum of the number of turns in each corresponding winding loop. For illustration consider the innermost loop where the nominal turns for the upper loop is +13 while the nominal turns for the lower loop is -3 (recalling that the sign indicates the relative winding direction) so that the net turns for this portion of the drive loop is +10. In contrast, when the switch 43 is in the upper position, the net number of turns in each loop is the difference of the turns in each corresponding winding loop. For the illustration above, the net turns for the innermost loop is then +16. The net number of turns for these different switch settings is illustrated in FIG. 9 and corresponds to a drive winding current distribution that would excite a single Fourier-Bessel mode for the magnetic field. The "sum" configuration here leads to a longer spatial wavelength mode while the "difference" configuration leads to a shorter spatial wavelength mode. This provides two distinct field depth of penetration conditions and permits improved multiple property measurements for layered media. The same approach can then be used for rectangular loops and the example turn distribution of Table 2 (page 27).

The phrase "magnetic field is biased" is used in the present application and Claims 4 and 5 to describe the biasing of the GMR sensor so that it is in a linear operating range. This is accomplished by applying a DC magnetic field locally to the sensor, as described on page 16, line 14 through page 17, line 28 of the specification.

Claims 1-14 and 46-48 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite. This rejection is respectfully traversed and reconsideration is requested.

As discussed above, all claim elements have been described in sufficient detail and definitiveness to enable one skilled in the art to practice the invention. In particular, all of the following elements have been illustrated and described in detail: two or more coils having

different winding distributions, how the relative current distributions are being switched, the discrete concentric loops, and what is meant by "magnetic field is biased".

With respect to the additional current carrying segments added to the primary windings, as claimed in amended claim 48, they are described on page 24, line 27 through page 25, line 20. In general, having a drive winding that imposes a sinusoidal current distribution and that also does not have a significant dipole moment is accomplished by adding additional segments near the ends of the drive winding. These additional segments typically do not follow the sinusoidal pattern since it is also advantageous to have the current near the ends of the primary taper to zero to prevent the field energy going into higher order spatial modes. In particular, page 25, lines 13-15 state that "The current in the last two segments deviates from the sinusoid but prevents the generation of higher order spatial modes." All of the claims are now believed to be in condition for allowance.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By Lubashev

Lyudmila Lubashev
Registration No. 55,408
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Dated: 8/4/04

Appl'n No.: 10/045,650
Title: DEEP PENETRATION MAGNETOQUASISTATIC...
Inventors: Ian Shay, *et al.*
Annotated Marked-Up Drawings

Replacement Figures:

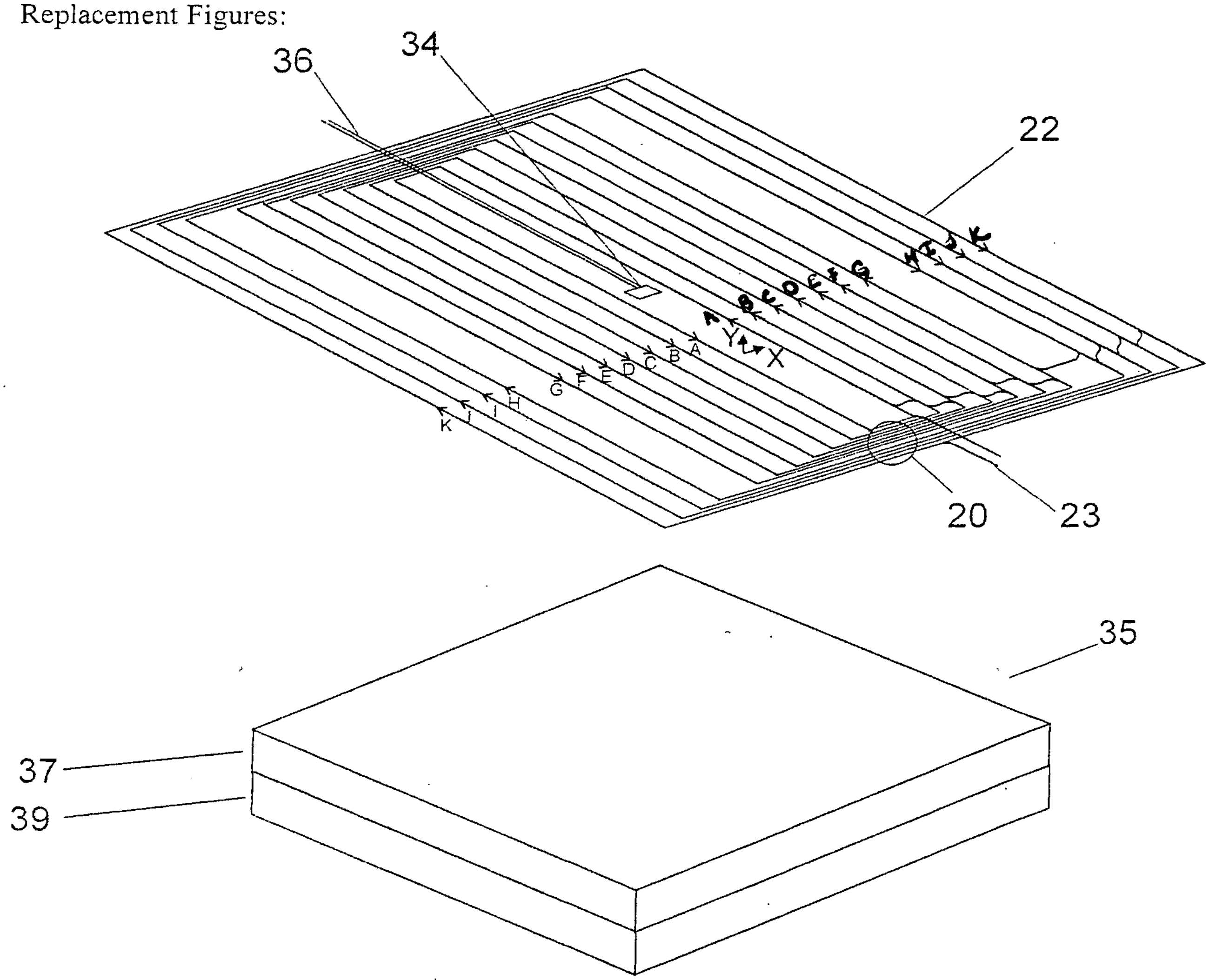

FIG. 4.

Appl'n No.: 10/045,650
Title: DEEP PENETRATION MAGNETOQUASISTATIC...
Inventors: Ian Shay, *et al.*
Annotated Marked-Up Drawings

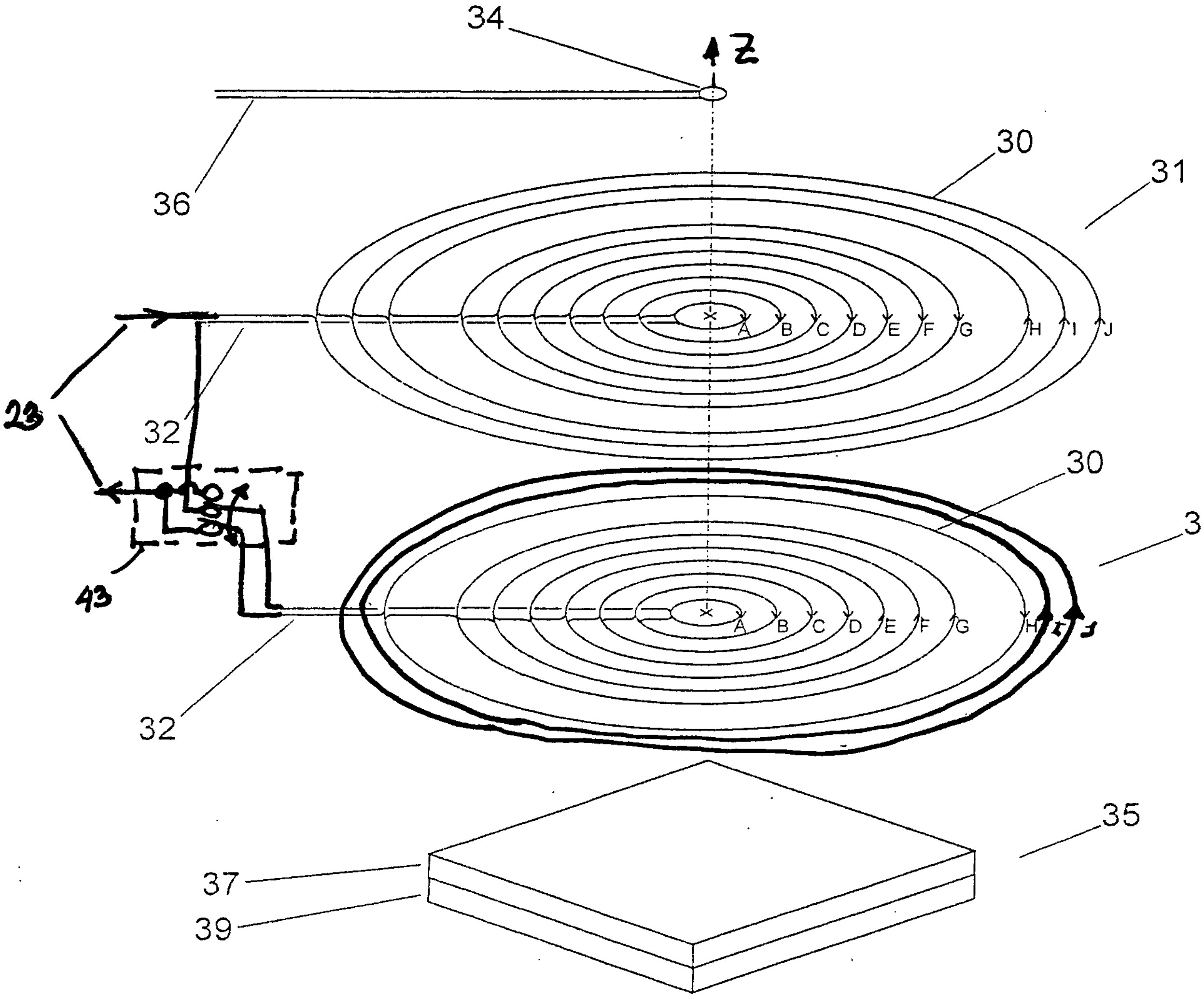

FIG. 5.